

Table of Contents

Dedication	5
 II Olympiad Algebra Solutions Manual for Book 2: Fundamentals of Trigonometry	 7
How to Use This Solutions Manual	9
1 Algebra Through the Ages, from Polygons to Complex Numbers	13
Identities and Transformations	13
Trigonometry in the Euclidean Plane	21
An Introduction to Spherical Trigonometry	25
Basics of Hyperbolic Trigonometry	27
How Did We Get Here?	32
2 Triangle Trigonometry: Half-Angles, Triangle Laws, and Radius Formulas	51
Half-Angle and Double-Angle Lessons	51
Triangle Laws and Geometric Quantities	61
Quadrilateral Trigonometry	161
3 Quick Quiz: Classical Contest Trigonometry	181
Normalization and Equation-Solving Lessons	181
Trigonometric and Arithmetic Detours	191
Recent Trigonometric Journal and Contest Problems	196
Triangle Metric Coordinates and Radius Algebra	208
Recent Geometry Problems with a Trigonometric Core	215
4 Trigonometric Series and Infinite Processes	225
Trigonometric Series	225
Problem Bank: Infinite Processes and Equation Solving	235
Graphs, Monotonicity, and Log-Trig Problems	266
Problem Bank: Open-Ended Classical Problems	272
Fourier Series Capstone: Turning Functions into Trigonometric Sums	307
5 Spherical Trigonometry	317
Great Circles and Spherical Triangle Foundations	317
6 Problem Studies: Historical and Advanced Spherical Geometry	397
Olympiad Geometry in Three Dimensions	397
Spherical Covering and Inequality Problems	429
Analytic and Vector Geometry in Space	447
Spherical Area and Solid Angle Tools	466
Advanced Solid Research Exercises	472
7 Contest Synthesis: Trigonometry, Exponentials, and Adjacent Methods	483
Curated Collection of Solved Real Contest Problems	483
Mock and Original Review Problems	511
Appendix A Neo-Sumerian and Old Babylonian Fields, Fronts, and Reciprocals	531

Ur III Field Plans and Geometric Division	531
Progressions and Proportional Sharing	560
Metrology, Administration, and Construction	570
Sexagesimal Tables of Reciprocals	584
Periodicity, Trigonometry, and Continued Fractions	592
Appendix B Lyran Power Tables and Exercises	631
Squares, Cubes, and Shadows of Pell's Equations	631
Quartic–Septic Lookup Tablets	634
Octic–Undecic Lookup Tablets	638
Duodecic–Quindecic Lookup Tablets	639
Octodecic–Vigintic Tablets	642
General Power Lookup Tablet Exercises	646
Related Trigonometric and Geometric Extensions	650
Appendix C The Polyarcs of Future Susa	661
Planar Lenses of the Past	661
Solid Lenses of the Future	681
Appendix D K.2069, Normalized 1;10, and Base-70 Reciprocal Periods	699
Repetends, Orders, and Midy Phenomena in Base 70	699
Appendix E Deep Logarithmic Table Geometry, Star Polytopes, and Laurent Hilbert Growth	701
Advanced Olympiad Problems: Platonic and Four-Polytopal Logarithmic Tables	701
Appendix F Algebraic Snapshots of the Common Era	725
Timeline Checkpoint: -0250	725
Timeline Checkpoint: +0499	729
Timeline Checkpoint: +1427	732
Timeline Checkpoint: +1730	734
Bibliography	747
Physical Resources	747
Online Resources	750
Acronyms	754
Notation	756
List of Problems in Solutions Manual	757
Indexes (Solutions Manual)	764
Index of Methods	765
Index of Theorems	769
Index of People	771
Index of Tools & Problem Types	773
Index of Sources	775